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Head and scapular posture in flutists: A pilot controlled study

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Instrumental practice which requires asymmetrical postures might, in the long term, potentiate musculoskeletal disorders and lead to pain. This, in turn, may have a negative impact on musical performance quality. Thus, the assessment of postural deviations among musicians is of the outmost importance in instrumental pedagogy. This study aims to compare the head and scapular posture of flutists with different levels of expertise and a control group of singers. Results suggest that flutists have a significantly more forward head posture than singers. No significant differences were found for any other head or scapular posture measurement. Contrary to what was hypothesized, years of instrumental practice did not contribute to a more asymmetrical posture.

Keywords: head posture; scapular posture; instrumental practice; flutists; singers

Playing an instrument requires hours of daily practice, repetitive movements, and asymmetrical positions of the body and high levels of mental concentration (Wynn Parry 2004). As a result, the instrumentalists' body often suffers adaptations. Some of these are positive, such as neuroplasticity, larger volume of grey matter and further development of visual and auditory cortex (Gaser and Schlaug 2003). However, others may impact negatively on the performer, such as the development of body asymmetries due to asymmetrical postures required to play certain instruments (Brandfonbrener 2000).

Flutists need to hold the instrument horizontally at the level of the right shoulder. This posture tends to rotate the waist and misalign the shoulders moving the left shoulder into adduction and flexion and the right shoulder into abduction and extension (Frank and Mühlen 2007). In addition, the head is side-flexed to the right and rotated to the left (Dommerholt 2000).

These asymmetrical postures require an increase in muscle activity of different muscle groups, force the flutist to depend on phasic shoulder muscles rather than postural tonic muscles and may lead to pain and fatigue (Dommerholt 2000). As developing expertise to play an instrument requires many hours of daily practice during several years, instruments who require asymmetrical postures may increase the risk of musculoskeletal injuries (Edling and Wiklund 2009). Thus, asymmetric body posture to play the flute may constitute one of the challenges that a flutist needs to overcome, as this may become more prominent with years of instrumental practice, leading to the development of playing-related pain.

This study aims to investigate (1) whether asymmetries in the upper body of flutists exist, (2) if they exist, whether they are more evident than for musicians who do not require asymmetric body postures (e.g. singers), and (3) whether head and scapular postures change with years of flute practice.

METHOD

Participants

Participants included flutists with different levels of expertise and an age- and expertise-matched group of singers. Flutists were divided into 2 groups: those with less than 10 years of instrumental practice (group 1; n=7) and those with more than 10 years of instrumental practice (group 2; n=10). As singing normally does not require asymmetric body postures, singers were chosen as controls (group 3; n=9).

Materials

The variables assessed in this study were head and scapular posture. Head posture was assessed through the measurement of angles between anatomical landmarks using a universal goniometer. A goniometer is made of two mobile arms fixed at a central point named the axis. A bubble level was used to maintain one of the goniometer's arm aligned with the horizontal line of reference. The posture of both the right and left scapulas was measured using measuring tape.

Procedure

Ethical approval to carry out this study was given by the Ethics Committee of the Hospital Infant D. Pedro, Aveiro.

Participants were recruited among flutists and singers from the Department of Communication and Art at the University of Aveiro. All participants

received information sheets explaining the study and provided written consent. Data was collected once for each participant and included measures of head and scapular posture.

Head posture was characterized by measuring three anatomic head angles: (1) the angle formed by the line connecting C7 to the tragus of the ear and the horizontal (this measures head position relative to the trunk, when the gaze is in horizontal or in a natural head posture; decreasing values indicate a more forward head posture), (2) the angle formed by the line connecting the tragus of the ear to the canthus of the eye and the horizontal (this allows measures of the position of the upper cervical spine, with increasing values being indicative of a more extended head), and (3) the angle formed by the line connecting the inferior margins of both ears and the horizontal, which provides information relative to side flexion. These angles were chosen because they had been used in previous studies to enable reliable comparisons (ICC≥0.71) (Silva *et al.* 2009). All measurements were repeated three times.

To assess the posture of the right and left scapulas, a similar protocol to Sobush *et al.* (1996) was followed—i.e. the participant remained in a relaxed position and four distances were measured: (1) the perpendicular distance between the superior angle of the scapula and the vertebral column, (2) the perpendicular distance between the inferior angle of the scapula and the vertebral column, (3) the perpendicular distance between the medial aspect of the root of the scapula and the vertebral column, and (4) the height difference between both scapulas. Before measuring these distances the anatomical points of reference in the scapula and a vertical line identifying the column were marked.

The statistical analysis was carried out using SPSS for Windows version 18 and Microsoft Excel 2007.

RESULTS

There were 6 female and 1 male flutists in group 1 and 7 female and 3 male flutists in group 2. This distribution reflects the fewer male flutists at the University of Aveiro. Thus, the control group was matched with groups 1 and 2 not only for age and level of expertise, but also for sex distribution. To maintain this balance, 7 female and 2 two male singers were selected for the control group.

The average ages of participants for each group were 19 years (range=17-21) for group 1; 29 years (range=23-55) for group 2; and 26 years (range=18-46) for group 3.

Table 1. Mean (±SD) differences between measurements for the left and right scapula (in cm).

	Superior angle	*Root of the spine*	*Inferior angle*	*Elevation*
Group 1	1.50 (±1.04)	1.07 (±0.52)	0.70 (±0.50)	1.35 (±1.35)
Group 2	1.40 (±1.29)	0.59 (±0.70)	0.67 (±0.54)	0.80 (±0.57)
Group 3	0.73 (±0.43)	0.79 (±0.47)	0.67 (±0.70)	1.23 (±0.73)

Table 2. Mean (±SD) angular values for head posture measurements (in degrees).

	Forward head posture	*Head extension*	*Head side-flexion*
Group 1	46.87 (±3.27)	20.30 (±4.09)	3.27 (±1.30)
Group 2	54.87 (±5.16)	22.98 (±5.38)	2.77 (±2.38)
Group 3	51.04 (±4.93)	19.06 (±5.14)	1.13 (±1.29)

Results suggested that asymmetries between right and left scapula in flutists tended to be higher when compared with singers (see Table 1); however, these differences were not statistically significant ($p>0.05$). Similarly, flutists seemed to have a more forward, extended, and side-flexed head than singers (see Table 2); however, this difference was statistically significant only for forward head posture ($p=0.04$), indicating a more forward head posture in flutists. Opposite to what was hypothesized, years of practice did not seem to contribute to poorer scapular or head postures ($p>0.05$).

DISCUSSION

Flutists showed a tendency for a more asymmetric scapular posture and a more forward head posture when compared with singers. Results thus support previous observations that one of the most common postural habits in musicians is a forward head posture (Dommerholt 2004). This, in the long term, might contribute to further problems, such as the development of pain, occlusal disturbances and poor breathing efficiency (Dommerholt 2004). Thus, it would be important to assess further this matter and investigate the extent to which different instrumentalists are affected by these postural deviations.

Our results suggest that years of flute practice do not seem to contribute to poorer postures. It is possible that over the years flutists learn practice strategies aiming to compensate for body asymmetries and postural deviations. However, these results need to be further investigated in future studies

with bigger sample sizes. Currently, we are developing this study to assess pain intensity related to these postures, as well as to investigate whether flutists develop coping strategies which potentially reduce the negative impacts of body postures assumed during instrumental practice.

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